

UNIVERSIDAD CATÓLICA DE LA SANTÍSIMA CONCEPCIÓN

FACULTAD DE EDUCACIÓN

PEDAGOGÍA EN EDUCACIÓN MEDIA EN INGLÉS



**PREVALENCE OF NEUROMYTHS AMONGST STUDENT-TEACHERS FROM
CHILE**

**Seminario de Investigación para optar al Grado Académico
De Licenciado en Educación**

PROFESOR GUÍA:

Dr. Roberto Andrés Ferreira Campos

ESTUDIANTES:

Lina Añazco Hermosilla.

Tania Contreras Novoa.

Claudia Millafilo Antilef.

Aracely Rodríguez Rodríguez.

CONCEPCIÓN, DICIEMBRE 2016

Abstract

This research focused on investigating the prevalence of neuromyths and the general neuroscience knowledge of student teachers from Chilean universities. The participants were 184 student teachers from three different programmes: English Programme, Special Education and Elementary Education. They were at different stages of their programmes. Participants answered a survey with thirty-two questions in total. Twenty of them were general neuroscience knowledge mixed with twelve other corresponding to neuromyths. The analyses were carried out using R software. Results showed that Chilean student teachers from all programmes believed in the same neuromyths about the brain, which coincided with the results of other research involving in-service teachers from different parts of the world. Likewise, this study established that there was a significant difference among the programmes in terms of the levels of general neuroscience knowledge and beliefs in neuromyths. Those results were mainly because of the presence or lack of neuroscience courses during the years of participants' tertiary education.

Key words: neuromyths, student teachers, teacher training, neuroscience, education.

Resumen

Esta investigación se enfocó en investigar la prevalencia de neuromitos y el conocimiento general de la neurociencia de los estudiantes de pedagogía de universidades chilenas. Los participantes fueron 184 estudiantes de tres programas diferentes: Pedagogía en Inglés, Educación Diferencial y Pedagogía en Enseñanza Básica, los cuales estaban en diferentes etapas de sus programas. Los participantes respondieron a una encuesta con treinta y dos preguntas en total. Veinte de ellas eran sobre conocimiento general de neurociencia mezclados con otros doce correspondientes a neuromitos. Los análisis se realizaron utilizando el software R. Los resultados mostraron que los maestros chilenos de todos los programas creían en los mismos neuromitos sobre el cerebro, lo cual coincidió con los resultados de otras investigaciones con maestros en servicio de diferentes partes del mundo. Del mismo modo, este estudio estableció que había una diferencia significativa entre los programas, en términos de niveles de conocimiento general de neurociencia y creencias en neuromitos. Estos resultados se debieron principalmente a la presencia o ausencia de cursos de neurociencia durante los años de educación terciaria de los participantes.

Palabras clave: neuromitos, estudiantes de pedagogía, formación docente, neurociencia, educación.

Table of contents

Abstract	2
Resumen	3
Table of contents	4
List of Tables.....	6
List of Figures	7
Acknowledgements	8
Chapter 1: Theoretical background	9
1.1. Introduction	9
1.2. Educational neuroscience	10
1.3. Neuromyths in education	13
1.4. Factors that may influence the origin of neuromyths	14
Chapter 2: Problem statement and research proposal	17
2.1. Justification	17
2.2. Research questions	18
2.3. Objectives.....	18
2.3.1. General objective.....	18
2.3.2. Specific objectives.....	18
2.4. Variables	18
2.4.1. Predictors.....	18
2.4.2. Outcome variable	19
2.5. Hypothesis.....	19

Chapter 3: The Study	20
3.1. Participants.....	20
3.2. Materials.....	20
3.3. Procedure.....	21
3.4. Data analysis	21
3.5. Results	21
3.5.1. General knowledge about the brain.....	22
3.5.2. Beliefs in Neuromyths by Programme	25
3.5.3. Correlation between GNK and beliefs in neuromyths	28
Chapter 4: Discussion, conclusions and limitations.....	29
4.1. Discussion and Limitations	29
4.2. Conclusions	32
References.....	33
Appendices.....	35
Appendix 1: Encuesta “Las neurociencias en el aula”	35
Appendix 2: Malla Curricular Pedagogía en Educación Media en Inglés, UCSC.....	38
Appendix 3: Malla Curricular Educación Diferencial, Universidad de Concepción	40
Appendix 4: Malla Curricular Educación General Básica, PUCV.....	41

List of Tables

Table 1 General knowledge about the brain (GNK)	23
Table 2 Beliefs in Neuromyths by Programme	25
Table 3 Percent correct responses to each general statement about the brain	26
Table 4 Percent beliefs in each neuromyth about the brain	28

List of Figures

Figure 1. MBE as a multidisciplinary field	12
Figure 2. Programmes on GNK	23
Figure 3. Programmes on INM	26
Figure 4. Correlation between GNK and INM	29

Acknowledgements

This research was supported by Proyecto Fondecyt 11130678.

We would like to express our gratitude to all of our families, partners and guide teacher for their contribution that helped us to complete our thesis project.

Chapter 1: Theoretical background

1.1. Introduction

Formal education has gone through several changes across history. Different paradigms and teachers' responses to students' needs have made both researchers and educators go beyond social studies to encounter science in order to enhance their practices, particularly these days when improving education has become a top priority for many nations. With this in mind, numerous educators around the world are turning to neuroscience in order to draw from its findings, relevant data that could improve their practice as well as enrich their students' educational outcomes. Nevertheless, because of the interest in how neuroscience informs education, several educational programs have appeared claiming to be "brain-based" without neuroscientific basis, generating misinterpretations and misapplications. This happens since most teachers do not receive neuroscientific training during their training programs, resulting in lack of knowledge with regard to neuroscience and neuroeducation from a critical perspective (Hook & Farrah, 2012). This situation leaves educators vulnerable to misconceptions about the practical use of neuroscience in the classroom resulting in neuromyths in education (OECD, 2002). With this in mind, this study focuses on presenting how overgeneralizations about neuroscientific findings, also known as "neuromyths", are prevalent among student-teachers and may erroneously influence their future pedagogical practice.

1.2. Educational neuroscience

Throughout the decades, the way students learn and the processes involved in learning have been a subject of numerous studies worldwide. Consequently, education has been the target of different approaches and theories that have tried to make a change in teaching practices. All of this with the purpose of improving pedagogy and consequently helping students learn successfully by promoting meaningful learning. For that reason, in recent years educators from all corners of the world have become increasingly enthusiastic about the latest contributions of neuroscience to education. This concern about neuroscience emerged from the interest in understanding how the human brain responds to different learning experiences and classroom environments. To illustrate this, John Bruer (1997) pointed out how this discipline interacts with other areas of expertise, such as; education and psychology (Hall, 2005). This educational interest in the brain depicts an increasing belief amongst scientists, as well as educators, leading to an interest of how education can take advantage of neuroscientific insights into how we develop and learn (Howard- Jones, 2007).

On one hand, neuroscience, as an interdisciplinary field which foremost goal has been to show a clear understanding of how the brain works at its most elementary level (Bear, Connors & Paradiso, 2007), has expanded its scope throughout the years to foster, for example, the branch of education. Progress in modern technology has provided neuroscientists insights about the brain functions. Functional neuroimaging, functional magnetic resonance imaging (fMRI), and positron emission tomography (PET) have allowed the measure of brain activity as individuals perform a task, broadening the knowledge about brain and its functions (Blakemore & Uta, 2000). In the same way, OECD (2007) states that neuroscience has contributed greatly to the understanding of the brain so as to enhance educational investigations, providing fundamental notions about the brain's design and its relevant functions such as how the brain learns throughout the lifespan, the importance of the environment in learning, and how language, numeracy and literacy are developed. Although neuroscientific and educational

research have granted significant material for improving education, there is an important area of study that has to be united with these two in order to start foreseeing a successful progress in schools: psychology.

The field of psychology, which studies the neural substrates of mental processes and their behavioral manifestations, has contributed to raising awareness of how certain behaviors affect others and can create opportunities for real world learning (Tokuhama-Espinosa, 2011). As Mareschal, Butterworth and Tolmie (2013) argue, psychology and educational research have a long history of contribution. Psychology analyzed the main factors that were recognized as the producers of learning differences, such as cognitive capacity and the different cognitive learning styles and from these methodologies and approaches were developed and included in educational research. Nowadays, psychology is still being applied to teaching and learning, because it helps educators to understand issues such as the factors that surround the whole process of learning in students and how teachers can maximize learning through their instructions (Tuckman & Monetti, 2010).

On the other hand, pedagogy is also considered a valuable source of information for neuroscience. As educators are interested in the contributions of neuroscience, they are asking for better presentation of scientific research. Furthermore, as teachers put into practice the discoveries, they can disclose to neuroscientists whether their findings are effective and applicable in the classroom. Likewise, teachers' reports can provide new suggestions for further neuroscientific studies. The relevance lies within the feedback teachers can provide, since without it neuroscience itself would be just a pure intellectual exercise.

Consequently, due to the need to enhance communication between the fields, Educational Science emerged. This new discipline, rooted in these three major disciplines which over the years have been amassing knowledge regarding the brain connected to the processes involved in teaching and learning, deals with how all learners can be helped to learn effectively as well as to achieve their learning potential, unifying and complying their unilateral findings into one for the sake of improvement in the learning-teaching experience. In this way, Samuels (2009) supports and postulates that in spite of the fact that science and education used to be

unrelated, these disciplines are closely interwoven (e.g., Tokuhamma-Espinosa, 2008) (see Figure 1).

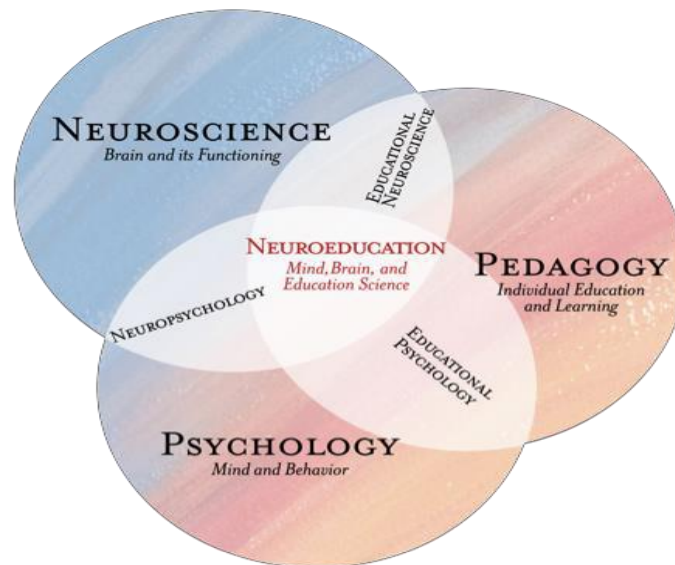


Figure 1: Mind Brain and Education as a multidisciplinary field (Tokuhamma- Espinosa, 2008).

Certainly, the rapid progress in this discipline has created new insights that promote the connection between education and neuroscience. In fact, teachers consider that if they understand the application of this discipline, they could open new pathways in order to improve learning and teaching. However, due to the lack of neuroscientific knowledge some teachers tend to misinterpret neuroscience explanations, and as a result, the claim that neuroscience informs and contributes to education is only based on misconceptions emerged without neuroscientific knowledge (Howard-Jones, 2006). Thus, there is a gap between contemporary science and the application of its finding to the classrooms, which is being consciously ignored by programmes pretending to be founded on brain science, such as Brain Gym (Goswami, 2006). Brain Gym was developed around 1970 and has so far expanded to more than 80 countries. This programme claims to help students activate both hemispheres of their brain by making different body movements.

Similarly, despite the remarkable progress, it is necessary to notice that the relationship between neuroscience and education has not been isolated from misunderstandings. This happens primarily because educators are vulnerable to misconceptions about the practical use of neuroscience in the classroom, due to the lack of interaction between neuroscientists and

educators. As Mareschal, Butterworth & Tolmie (2013) point out, several authors have stated the gap between education and neuroscience, and how some of the findings are not strong enough to be applied in the classroom. To illustrate, Bruer (1997, 1992) asks educators to maintain their classroom practices far from neuroscience as he states that the neuroscientific research is still not adequate for classroom application. It is because of the fact that over the past years, there have been numerous articles, books, and information in the social media about the application of neuroscience to education so that educators give different interpretations to those findings. This situation has unleashed misconceptions, which now receive the name of neuromyths in education.

1.3. Neuromyths in education

Undoubtedly, educators worldwide are enthusiastic about keeping up with the latest neuroscientific facts regarding how they can develop their students' minds and brains in order to apply them into their classrooms. However, due to their interest and the pressure of improving school performance, several myths and misconceptions have arisen about how best the human brain learns (OECD, 2002). Likewise, Howard-Jones (2009) supports and claims that there was a period when there was not a formal interdisciplinary communication between education and neuroscience, by the same token, it allowed the emergence of these unscientific 'brain-based' ideas among teachers and consequently they apply them in the classrooms.

As a result, misconceptions in neuroscience were then conceived as neuromyths and this term was first introduced by Crockard (1980) to allude to misunderstood notions about the brain in the medical field. Decades later and due to the emergence of "neuromyths" in education, the Organization for Economic Cooperation and Development (OECD) redefined neuromyth as "misconception generated by a misunderstanding, a misreading or a misquoting of facts scientifically established (by brain research) to make a case for use of brain research in education and other contexts" (2002, p.2).

Certainly, for more than two decades, plenty of sources of information without neuroscientific basis have been released, and as a result, several ideas based on these sources

have emerged as part of the educational context in numerous schools (Howard-Jones, 2006). It happens because teachers are eager to put in practice what they read in the media which seems to be based on neuroscientific research. As repercussion, this situation generates a waste of time and money not only for teachers, but also for schools and parents because they invest in the success of these neuro-educational products (Hook & Farah, 2012). That is why Tardif, Doudin, and Meylan (2015) defined neuromyths in education as misconceptions among teachers, associated with brain functioning and learning, primarily because teachers do not have the capacity to differentiate fact from fiction, so that myths have spread quickly developing a delay in applying brain research to education (OECD, 2002).

1.4. Factors that may influence the origin of neuromyths

Although several authors blame the appearance of the so-called neuromyths on commercial executives, trying to profit from the brain-based trend, Howard-Jones (2014) states that cultural conditions such as language barrier and specific terminology vary among educators and neuroscientists, predisposing the appearance of neuromyths. Due to this, there are more possibilities that the scientific knowledge could be transform into misleading ideas or what is well known as neuromyths. That is why Howard-Jones (2014) points out the complexity of the findings themselves and the little access that people have to study them in depth; non-specialists are more likely to miss the studies or misinterpret them, hence spreading the myths. Nonetheless, most neuromyths have some scientific background; that is to say, that they have brought their claims from a set of scientific findings (Howard-Jones, 2014, p.817). To illustrate this, one of the most recognized neuromyths was based on “enriched environments” (Greenfield, 2007). That is to say, surroundings that can fully provide sensory input and better physical resources for children with the ultimate goal to enhance learning during the critical period (0 to 3 years old), and the lack of exposure to this generates a void in learning. However, this neuromyth came from an experiment made with rodents, in which they had to solve maze problems. Findings showed that there was a major difference among the rodents, which were divested from this type of environment and those which were not (Diamond et al., 1964).

Likewise, in spite of that research there is not scientific proof supporting similar results in rodents and humans.

Due to the proliferation of these non-scientifically valid pretenses, numerous investigations have been carried out in order to establish the origin and prevalence of neuromyths among teachers. For example, a study conducted by Ferrero et al. (2016) showed the prevalence of neuromyths among 284 Spanish teachers from different levels and different types of institutions. The results of this study revealed that 49.1% failed to recognize neuromyths, from which can be highlighted the most popular ones such as “environments that are rich in stimulus improve the brains of pre-school children”, believed by 94% teachers; “individuals learn better when they receive information in their preferred learning style”, believed by 91.1% participants; and "exercises that rehearse coordination of motor-perception skills can improve literacy skills", believed by 82% teachers. Comparisons with previous studies lead Ferrero et al. (2016) to the conclusion that those neuromyths are extraordinarily popular not only in the different regions of Spain but also across other countries.

On the other hand, the study conducted by Dekker et al. (2012) focused on establishing the prevalence of neuromyths amidst teachers in the United Kingdom and the Netherlands by applying a survey. The participants of this study were 242 teachers from the primary and secondary level, who were not informed about the real purpose of this study, neither the term neuromyth was mentioned. The research was presented with the objective to find out what teachers think about the brain and its influence on learning. The data showed that a vast percentage of teachers believed in neuromyths, especially those related to the commercialization of the neuroscience-related concepts in education. Similarly, another survey, administered to 628 Portuguese teachers (from different educational levels, Preschool to Highschool, and diverse areas of expertise aged between 25 and 61 years old) demonstrated that teachers were not able to distinguish myths from facts (Rato & Caldasa, 2013). The method used was based on a questionnaire presenting myths and non-myths so as to assess teachers' beliefs in neuromyths. Among those neuromyths, there were some included by Howard-Jones (2007) in his research study, such as the different learning styles, the hemispheric dominance and the use of a small

proportion of the brain. A more recent study carried out by Gleichgerrcht et al. (2015) determined that teachers at all levels were more likely to believe in neuromyths. The research evaluated the belief in neuromyths among 3,451 Latin American teachers who taught at all levels. Teachers completed both a questionnaire and a survey. The questionnaire informed about teachers' demographic and professional backgrounds, if they were familiar with science articles and the amount of access they had had to information about the brain. Additionally, the survey presented a Spanish translation from the 32 statements about the brain and learning/education used by Dekker et al. (2012). The results showed that more than half of the participants had some knowledge about neuroscience and that on average half of them failed to identify neuromyths from facts. In addition, Peruvian participants had the lowest neuroscience literacy from the Latin American participants and in comparison with the study made by Howard-Jones (2007), the belief in neuromyths was higher in Latin America than in Europe. The latter might be due to fact that Latin American teachers have limited access to neuroscientific texts in Spanish and they may not have a thorough understanding of what they read in English.

In all the cases, there seems to be a tendency shown by participants to believe in similar neuromyths in spite of the cultural differences. For example, the most common neuromyths in those studies were related to learning styles (e.g. Visual, auditory and kinesthetic), hemispheric dominance (left brain, right brain), and Brain Gym (Tardif et.al., 2015). This pervasiveness may be due of the lack of neuroscience training in teachers, who are unprepared to criticize notions and alleged brain-based educational programmes (Howard-Jones, 2014). In addition, being neophyte in the area makes teachers more susceptible to commercialized neuroscientific facts because of their enthusiasm for learning and their lack of knowledge to discriminate effective material from one lacking of evidence (Rato & Caldasa, 2013).

Furthermore, the interdisciplinary relationship between neuroscience and education can open doors to new opportunities for education practice and policy. Nevertheless, it is difficult for teachers and students to discriminate between “the good, the bad, and the ugly” about neuroscience findings applied to education. Vast investigations carried out in several contexts support the relevance to shed light into the appearance and pervasiveness of neuromyths. That is

why it is of the utmost importance to conduct a similar research in our country regarding neuromyths, as supported by several authors, so as to understand the different factors that determine student-teachers' beliefs in neuromyths in the Chilean educational context, in order to mend the current situation of confusion that exists around this topic.

Chapter 2: Problem statement and research proposal

2.1. Justification

Educational research over the years has come across different disciplines with the goal of ensuring students' learning. With the birth of educational neuroscience, the interest of teachers in learning neuroscience has arisen (Pickering & Howard-Jones, 2007). However, this has become a business opportunity in some countries by the commercialization of educational programmes that claim to be based on neuroscience, misinterpreting the findings and ensuring amazing results among students who learn under their methodologies. Besides, selling "brain-based programmes" to teachers or future teachers becomes even much easier when their buyers do not possess a deeper knowledge of the subject or are eager to innovate in their classrooms. The implications of this problem are translated into a negative impact on the teaching and learning environment, since educators or non-specialists are not knowledgeable about basic neuroscience concepts; therefore, they have difficulties in interpreting the scientific information or they simply miss it or ignore it (Howard-Jones, 2014). This is a consequence of the lack of training in science during their tertiary education, hence mistakes can be observed in their teaching practices, affecting not only their performances, but also their students' learning process (Cofré et al., 2010).

Under the premise that limited research has been carried out in Chile regarding the prevalence of neuromyths among different education programmes, the urgency for investigating this topic is crucial to improve practices of teachers when applying neuroscience in the classrooms and to prevent future teachers from following the same path, in consideration that no previous studies in Chile have investigated pre-service teachers' beliefs about neuroscience.

That is why this study covers student-teachers' knowledge and beliefs about neuromyths in the context of Chilean education. This investigation presents as well as describes the prevalence of neuromyths in student-teachers from different education programmes offered at three Chilean universities, and determines a set of predictors: interest in neuroscience, general neuroscience knowledge (GNK), age, year of study, university, and confidence answering the survey (CAS).

2.2. Research questions

- What are the most common neuromyths among student-teachers in Chile?
- Are there any differences between student-teachers among the 3 different programmes regarding their general knowledge of neuroscience and their beliefs in neuromyths?

2.3. Objectives

2.3.1. General objective

- To investigate the prevalence of neuromyths among student-teachers in Chile.

2.3.2. Specific objectives

- To identify the prevalence of neuromyths among Chilean student-teachers from 3 different university programmes.
- To identify the amount of general knowledge of neuroscience among Chilean student-teachers from 3 different university programmes.

2.4. Variables

2.4.1. Predictors

There are factors that may influence the origin of neuromyths and neuroscience knowledge. These factors are:

- Presence of neuroscience courses during the years of participants' tertiary education.
- Lack of neuroscience courses during the years of participants' tertiary education.

2.4.2. Outcome variable

- The percentage of correct neuroscience statements.

2.5. Hypothesis

- H1: Student-teachers who have taken a neuroscience course are less likely to believe in neuromyths.
- H2: Student-teachers who have never taken a neuroscience course are more likely to believe in neuromyths.

Chapter 3: The Study

3.1. Participants

The participants of this study comprised 184 student-teachers from three different five-year teaching programmes: English Programme (EP), Special Education Programme (SEP) and the Elementary Education Programme (EEP). Participants' mean age was 22.7 years (range= 18- 47). The student-teachers were studying at different stages of their programmes, fluctuating between first to fifth year. Similarly, all of them were enrolled at three Chilean universities from two different regions of the country: Universidad de Concepción (n= 52), Pontificia Universidad Católica de Valparaíso (n=29) and Universidad Católica de la Santísima Concepción (n=103).

3.2. Materials

In order to gather data, an online survey, based on the questionnaire used by Dekker et al. in 2012, was applied to student-teachers from different areas in Chile. This survey was presented in Spanish titled as “Neurosciences in the Classroom” and was divided in two parts: the first one about participants' background information; the second part with several statements about neuroscience (see Appendix 1.1).

In the first part of the survey, which corresponded to participants' background, participants had to answer questions about their personal and professional information. This aspect collected information about the participants' age, year of study, programme and knowledge about its curriculum, their knowledge and practices regarding neuroscience in the classroom and their interest in neuroscience.

The second part of this survey corresponded to 32 different statements about learning and neuroscience, of which 20 are valid statements about the brain, and 12 are incorrect statements corresponding to neuromyths, displayed randomly. The word neuromyth was never mentioned during the study, and participants were asked to respond the survey by using the alternatives: Correct, Incorrect, or Do not know (see Appendix 1.1).

3.3. Procedure

Participants were asked to complete an online survey using Google forms. Respondents were recruited by email, the link of this survey was posted on Facebook groups in order to collect data from student-teachers from different places as well. Some English Pedagogy students at the UCSC were asked to answer the survey during class.

Participants were required to read and sign a consent form in order to take part of this study, to later complete the two-part survey. The survey took on average 15 minutes to complete. This survey also included a Likert scale (from 1 to 7) to assess how confident the participants felt about their answers.

3.4. Data analysis

Data analysis was conducted using R (R Core Team, 2015). Analysis of variance (ANOVA) was used to examine the main effect of programme on neuromyths and the general neuroscience knowledge (GNK) among the three programmes: English Programme (EP), Special Education Programme (SEP) and Elementary Education Programme (EEP). A series of two-sample T-test were also conducted in order to assess the differences between programmes.

3.5. Results

The participants in this study were enrolled at different levels of their higher education stage. Out of the 184 students, 31 (16.7%) of them were in first year, 16 (8.6%) were in their second year, 48 (25.8%) in third year, 55 (29.6%) in fourth year, and 34 (18.4%) in their fifth or final year. Forty five students, corresponding to 24.4%, indicated that they had enrolled in a neuroscience course and a hundred and ten of them had never taken any neuroscience class at university. The thirty one remaining student-teachers did not respond to this question. In general terms, considerable interest in neuroscience was recounted, assigning a rating of 5.54 in a 1-7 Likert scale. Nevertheless, self-reported knowledge of neuroscience (SRKN) barely reached 2.8 in the same 1-7 likert scale. A total of 15.6 % of the participants indicated that they often read

scientific magazines. Lastly, confidence in answering the survey (CAS) reached a 4.6 out of a maximum of 7 (Ferreira and Varas, 2016).

3.5.1. General knowledge about the brain

In terms of general neuroscience knowledge (GNK), our data suggest that 59.8% of the participants responded correctly to the assertions about the brain and its functioning (see Table 1).

Table 1
General knowledge about the brain (GNK)

	SEP	EEP	EP
Mean	60.1	66.4	53.1
SD	14.9	14.8	13.4

A one-way independent ANOVA was conducted on the data, which shows that there is a main effect of Programme, $F(2,181)=275, p <.001$ (see Figure 2).

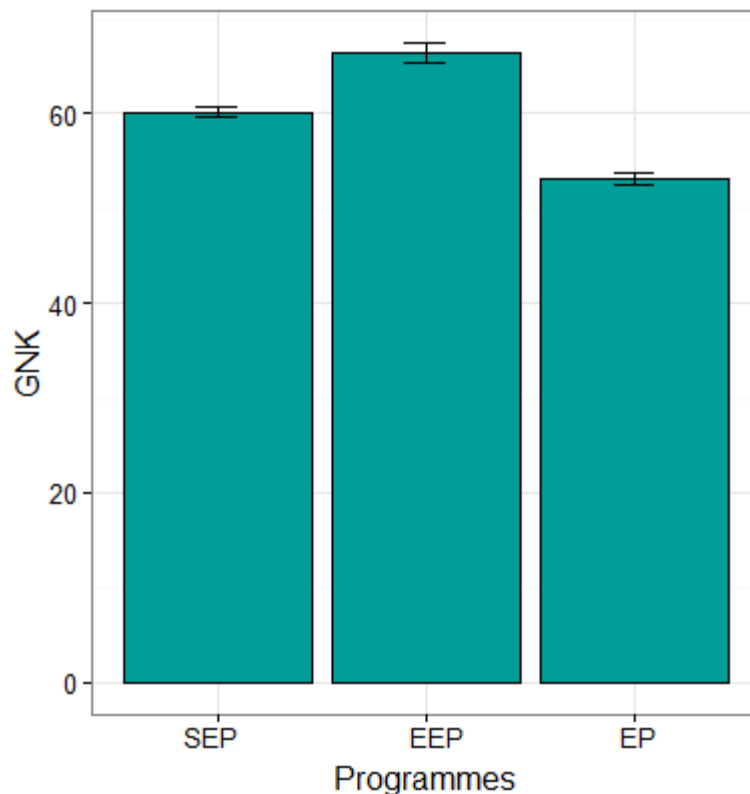


Figure 2. General knowledge of neuroscience across programmes

EEP has a distribution between the values 30 and 90, with a median of 65. In this distribution, 50% of the data (or the box in the graph) are above the value 60; therefore, those students (SEP & EEP programmes) have higher levels of GNK. EP, for example, has a distribution between 20 and 75, with a median of 55 which means that students from this programme have less General knowledge of neuroscience.

Since there was a main effect of programme on GNK. We decided to conduct post hoc tests. The comparisons included students of English (EP) vs. Special Education students (SEP), students of English (EP) vs. Elementary Education students (EEP), and Special Education students (SEP) vs. Elementary Education students (EEP).

EP versus SEP

The data illustrated that there is a substantial difference between the answers provided by students from English Programme (EP) and Special Education Programme (SEP), $t(159)=17.248$, $p < .001$. These results report that participants in SEP had a better performance, that is to say they had more knowledge about neuroscience in comparison with participants in EP.

EP versus EEP

The data showed that there is a significant difference between the answers provided by students in English Programme (EP) and Elementary Education Programme (EEP), $t(87)=21.873$, $p < .001$. The results tell us that participants in the former programme know less about neuroscience than the latter.

SEP versus EEP

The data revealed a significant difference between the answers provided by students from the Elementary Education Programme (EEP) and Special Education (SEP). Students from Elementary Education were better at identifying neuromyths than those in the Special Education Programme $t(122)=-10,663$, $p < .001$.

Table 2

Percent correct responses to each general statement about the brain sorted by overall decreasing performance.

Order	General statements about the brain	Percent
1	Individual learners show preferences for the mode in which they receive	98.4
2	There are sensitive periods in childhood when it is easier to learn things.	94.6
3	We use our brains 24 hours a day.	91.3
4	When we sleep, our brains shut down.	90.8
5	Mental capacity is hereditary and cannot be changed by the environment or experience.	89.1
6	Academic achievement can be affected by skipping breakfast.	74.5
7	Vigorous exercise can improve mental function.	66.3
8	Information is stored in the brain in a network of cells distributed throughout the brain.	64.1
9	Learning occurs through modification of the brains' neural connections.	61.4
10	Production of new connections in the brain can continue into old age.	58.2
11	Brain development has finished by the time children reach secondary school.	57.1
12	Extended rehearsal of some mental processes can change the shape and structure of some parts of the brain.	57.1
13	Normal development of the human brain involves the birth and death of brain cells.	55.4
14	Circadian rhythms ("body clock") shift during adolescence, causing pupils to be more tired during the first lessons of the school day.	44.6
15	When brain region is damaged, other parts of the brain can take up its function.	42.4
16	The brains of boys and girls develop at the same rate.	37.5
17	Learning is not due to the addition of new cells to the brain.	31.0
18	Regular drinking of caffeinated drinks reduces alertness.	26.6
19	The left and right hemispheres of the brain always work together.	23.4
20	Boys have bigger brains than girls.	7.1

3.5.2. Beliefs in Neuromyths by Programme

In terms of beliefs in neuromyths we compared the prevalence of neuromyths among student-teachers from the three programmes; SEP, EEP and EP (see Table 3).

Table 3
Beliefs in Neuromyths by Programme

	SEP	EEP	EP
Mean	51.2	52.9	49.3
Sd	14.9	14.8	15.2

The table 2 exemplifies a significant effect of the participants' programmes of origin (SEP, EEP and EP) on the belief of neuromyths (INM), $F(2,181) = 19.66, p < .001$.

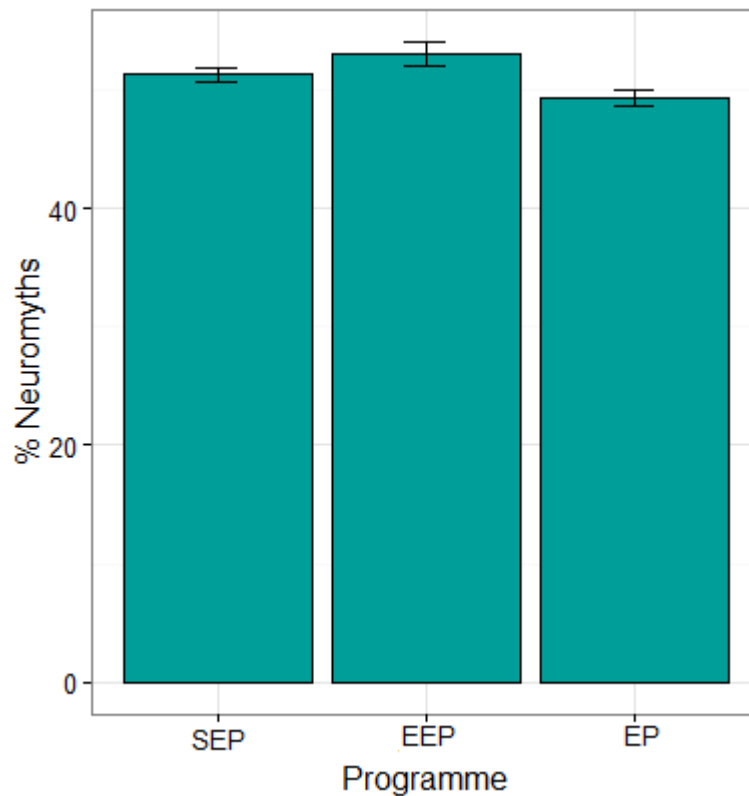


Figure 3. Relation between programmes and the belief of neuromyths.

Figure 3 illustrates that in general terms, EP, SEP and EEP have similar levels of INM, although more concentrated in lower values in SEP and EEP around the value 50.

Due to the substantial differences between the answers provided by students from the three Programmes, an independent sample t-test was conducted to compare the prevalence of neuromyths among students from EP, EEP, and SEP. $F(2,183) = 19.66, p < .001$.

EP versus SEP

The results illustrated a significant difference between the programmes, $t(159) = 4.51, p < .001$. To be more specific, students of the Special Education Programme (SEP) believe more in neuromyths than those from the English programme (EP).

EP versus EEP

There was a significant difference between English and Elementary Education Programmes (EP and EEP, respectively), $t(87), 5.83 = p < .001$. This suggests that the participants who study English were better at recognizing neuromyths than the students from the other programmes (EEP).

SEP versus EEP

There was a difference between the results of participants from both Special Education and Elementary Education Programmes, $t(122), -2.88 = p < .001$. Students who are currently studying Special Education recognized more neuromyths than the latter (EEP).

Table 4
Percent beliefs in each neuromyth about the brain sorted by overall increasing performance

Order	Neuromyths	Percent correct
1	Individuals learn better when they receive information in their preferred learning style (e.g., auditory, visual, and kinesthetic).	95.6
2	Environments that are rich in stimulus improve the brains of pre-school children.	87.5
3	Differences in hemispheric dominance (left brain, right brain) can help explain individual differences among learners.	76.0
4	It has been scientifically proven that fatty acids supplements (omega-3 and omega-6) have a positive effect on academic achievement.	67.9
5	Short bouts of coordination exercises can improve integration of left and right hemispheric brain function.	56.5
6	We only use 10% of our brain.	54.8
7	Children are less attentive after consuming sugary drinks and/or snacks.	50.5
8	There are critical periods in childhood after which certain things can no longer be learned.	46.1
9	Exercises that rehearse coordination of motor-perception skills can improve literacy skills.	41.3
10	Children must acquire their native language before a second language is learned.	30.4
11	Learning problems associated with developmental differences in brain function cannot be remediated by education.	14.6
12	If students do not drink sufficient amounts of water (= 6-8 glasses a day) their brain shrinks.	1.0

Finally, considering the results of these analyses, it could be established that student-teachers from EP were better at identifying neuromyths. This result was different to the second hypothesis of this study, which mentions that student-teachers who have never taken a neuroscience course are more likely to believe in neuromyths. Hence, in spite of the fact that EP students did not have a neuroscience course in their curriculum, they were more capable of identifying neuromyths than student-teachers from SEP and EEP.

3.5.3. Correlation between GNK and beliefs in neuromyths

Figure 4 illustrates the existence of a correlation between the belief in neuromyths of student-teachers from the three programmes (EP, SEP, and EEP) and the general knowledge about neuroscience. As figure 4 shows the data on the map have some average concentration ($r=0.37$), in other words, the belief in neuromyths increases with the amount of general neuroscience knowledge $p < 0.001$.

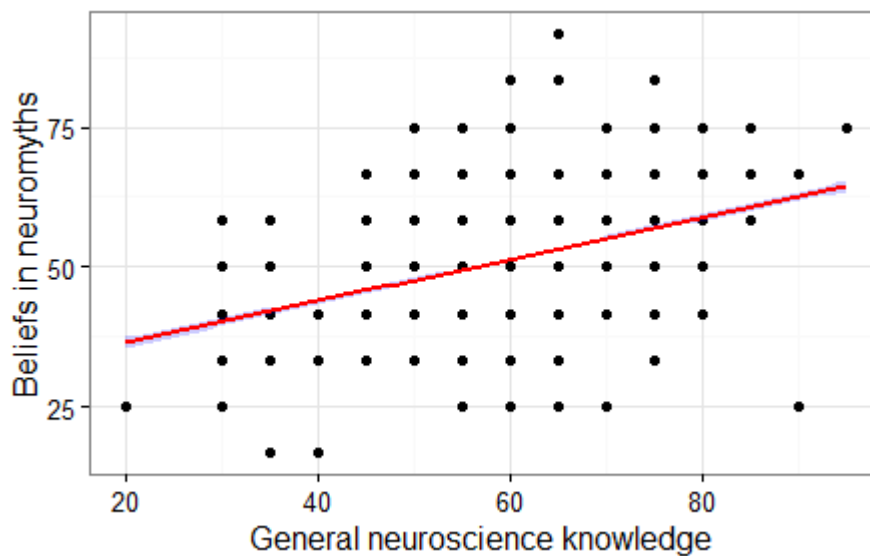


Figure 4. Correlation between general neuroscience knowledge and beliefs in neuromyths.

Finally, the results suggested that student-teachers from EP, SEP, and EEP tend to believe in the same neuromyths about the brain. However, there is a significant difference among the programmes that is why we decided to conduct a two-sample t-test. The most significant difference was found when analysing the results of EEP student-teachers since these participants were more likely to believe in neuromyths. This result did not support what was established in one of the hypotheses, which mentions that student-teachers who have taken a neuroscience course are less likely to believe in neuromyths. Thus, it could be said that the more knowledge about neuroscience the more beliefs in neuromyths.

Chapter 4: Discussion, conclusions and limitations

4.1. Discussion and Limitations

The present study explored the prevalence of neuromyths and general neuroscience knowledge (GNK) of a group of student-teachers from three different programmes: Special Education, Elementary Education and English Programme, each from different universities in Chile.

Data collected showed that when comparing the three programmes, those students enrolled in the Elementary Education programme had a higher percentage of general neuroscience knowledge (GNK); however, the same participants also surpassed their peers in the amount of neuromyths they conceived as true. Contrary to what was found by Howard-Jones et al. (2009) a high percentage of GNK would prevent the belief in neuromyths; however, our results suggest that the knowledge of neuroscience did not prevent student-teachers from having misconceptions about how the brain works. On the contrary, it increased the belief in neuromyths, which is in line with Dekker et al. (2012) and Gleichgerrcht et al. (2015). The possible origin of this might be connected to the fact that these neuromyths are in fact somewhat- based on neuroscience knowledge.

Regarding neuromyths, we found that 51.1% of the student-teachers were unsuccessful to identify misconceptions about the brain. This result resembles those discovered in other international studies (Dekker et al., 2012; Gleichgerrcht et al., 2015; Howard-Jones, 2014) in which plenty of participants were not able to identify myths from facts about the brain. However, in relation to one of the hypotheses of our study, which declared that beliefs in neuromyths are more common among student-teachers who have never taken a neuroscience course. It has been shown that the more knowledgeable participants are in neuroscience, the more likely they are to believe in neuromyths. One of the reasons that can justify this finding is the fact that most universities do not provide students with courses from which they could get reliable information and sources related to neuroscience. Likewise, although student-teachers from SEP and EEP showed a larger amount of general knowledge in neuroscience (in

comparison with EP), they failed to identify the incorrect statements about the brain. Another reason that can explain this phenomenon can be the absence of basic neuroscience instruction in the education programmes offered in Chile.

In addition to that, it was noticeable, because of the answers provided in the survey, that student-teachers who show an interest in neuroscience were more likely to believe in neuromyths. This can be explained by the high eagerness student-teachers have in order to learn “neuroscientific” strategies, in other words, the more eager they are, the more they believe in all the information found and received on social media, never doubting or questioning about the content (where it comes from, whether it is reliable or not, etc). In fact, in our study 79.8% (147 participants) of the informants declared to be interested in neuroscience; furthermore, even though students showed an interest in neuroscience they were not capable of distinguishing science-based facts from myths. Another reason why there is a proliferation of neuromyths among student-teachers in Chile, is because of the fact that student-teachers from EEP and SEP do not have an intense English language training during their years of study. That is why they lack of a good understanding of the English language and as most of the papers and research are written in this foreign language, so they might misunderstand the scientific information. As stated by Gleichgerrcht et al. (2015), the absence of Spanish contents may be a reason for these misconceptions.

On the other hand, the most accepted neuromyths in our study were related to learning styles (e.g. Visual, auditory and kinesthetic), hemispheric dominance (left brain, right brain), and Brain Gym (Tardif et al., 2015). These coincide with the most popular misconceptions in studies by Dekker et al (2012) and Gleichgerrcht et al. (2015). However, based on the data provided by the survey, the year of study restricted students from believing in neuromyths. In this particular case, those students who had gone through more years of tertiary education tend to believe in a lower percentage of neuromyths in contrast to those who were novice. This result could be linked to amount of academic material students are exposed to throughout the years which might have developed in them an ability to identify what could be right (sufficiently supported by science) or wrong (Gleichgerrcht et al., 2015).

Despite the fact this research has achieved its objectives, there is one possible limitation related to the sample. The lack of prior research studies on this topic, especially in the Chilean context. Because of that situation, it was difficult to add and find out relevant information about neuromyths. This could be probably because people are not aware of the existence of neuromyths, which are often based on scientific discoveries that seem to be reliable. However, awareness of those erroneous beliefs about how the brain works may serve to decrease the prevalence of those misconceptions about the brain. Thus, it was not possible to compare the results of this study with a Chilean one, since it was even impossible to cite prior research studies from Chile because there were not enough studies about this topic in our country.

In terms of the implications of our study, the results drawn suggest this would greatly contribute to education as this would be the only study in Chile that would focus on the prevalence of neuromyths among student-teachers. Furthermore, by presenting these results student-teachers will become aware of the most common neuromyths and therefore, they could become more critical when encountering new information claiming to be neuroscience-based. Similarly, in regards of the teaching exercise, this study will prevent student-teachers from taking neuroscience based activities to the classroom without making some further research.

As previously stated, insufficient research has been done regarding the misconceptions about the brain prevalent in teacher and student teachers from Chile, it is suggested that future research should investigate the impact that these beliefs have inside the classroom and on students' learning. Furthermore, in agreement with the claims by Jolles et al (2005), researchers ought to minimize the current gap that exists between neuroscience and education, as this constitutes the perfect environment for misconceptions to arise specially on novice students and teachers. Similarly, student-teachers should be more exposed to neuroscience courses in their training as teachers, since this would not only give them the tools to learn more about the application of neuroscience to education, but it would also prevent them from believing in popular neuromyths.

4.2. Conclusions

This research investigated the prevalence of neuromyths amongst student-teachers from Chile. The most relevant finding drawn from this study has to do with the strong correlation between programmes and beliefs on neuromyths. That is to say that the more knowledge about neuroscience, the more misconceptions about how the brain works as supported in previous studies. To illustrate this, based on the analyses and the curriculum of each programme, we could establish that student-teachers from EEP and SEP were more likely to believe in neuromyths in spite of the fact that they had taken a neuroscience course. Thus, we can speculate that a neuroscience training during their formal education could not prevent students from believing in neuromyths.

Nevertheless, the most significant difference was found in terms of general knowledge about the brain. For instance, student-teachers from PI were more likely to identify neuromyths than those from SEP, and EEP. Likewise, student-teachers from EP, SEP, and EEP tend to believe in the same neuromyths about the brain. As a matter fact, the most popular neuromyth was the one stating that individuals learn better when they receive information in their preferred learning style.

Finally, evidence from this study suggested that Chilean student-teachers presented a high prevalence of misconceptions about the brain, which coincided with the results of other research involving in-service teachers from different parts of the world. This lead us to believe that these erroneous ideas were prevalent from pre-service to in-service phase, which were later brought into the classrooms.

References

- Blakemore, S., & Frith, U. (2000). *The implications of recent developments in neuroscience*. London: Institute of Cognitive Neuroscience.
- Bruer, J. (1997). Education and the brain: A bridge too far. *Educational Researcher*, 4-16.
- Bruer, J. (1999). *The Myth of the First Three Years: A new understanding of early brain development and lifelong learning*. New York: Free Press.
- Coffield, F., Moseley, D., Hall, E & Ecclestone, K. (2004) *Learning styles and pedagogy in post-16 learning: a systematic and critical review*. London; Learning and Skills Network.
- Cofré, H., Camacho, J., Galaz, A., Jiménez, J., & Santibáñez, D. (2010). La educación científica en Chile: debilidades de la enseñanza y futuros desafíos de la educación de profesores de ciencia. *Estudios Pedagógicos*, XXXVI (2), 279–293.
- Dekker, S., Lee, N. C., Howard-Jones, P., & Jolles, J. (2012). Neuromyths in education: Prevalence and predictors of misconceptions among teachers. *Frontiers in Psychology*, 3(429), 1-8.
- Diamond, M., Krech, D., & Rosenzweig, M. (1964). The effects of an Enriched Environment on the Rat Cerebral Cortex. *Journal of Comparative Neurology*, 111-119.
- Espinosa, T. T., & Willis, L. (2011). *Mind, brain, and education science: A comprehensive guide to the new brain based teaching*. New York: w.w. Norton.
- Gleichgerrcht, E., Luttges, B. L., Salvarezza, F., & Campos, A. L. (2015). Educational neuromyths among teachers in Latin America. *Mind, Brain, and Education*, 170-178.
- Goswami, U. (2006). Neuroscience and education: From research to practice? *Nature Reviews Neuroscience*, 406-413.
- Howard-Jones, P. (2006, June). *Neuroscience and education: issues and opportunities*. Retrieved November 3, 2015, from a commentary by the teaching and learning research programme:
<http://www.tlrp.org/pub/documents/Neuroscience%20Commentary%20FINAL.pdf>

- Howard-Jones, P. A. (2007). *Neuroscience and education: Issues and opportunities*. A Comentary by the Teaching and Learning Research Programme. TLRP/ESRC, 27.
- Howard-Jones, P. A. (2014). Neuroscience and education: myths and messages. *Nature Reviews Neuroscience*, 818-824.
- Hook, C. J., & Farah, M. J. (2012, April 11). Neuroscience for Educators: What Are They Seeking, and What Are They Finding? *Center for Neuroscience & Society*, 1-11.
- Johnson, M. (1997). *Development cognitive neuroscience: An introduction*. Oxford: Blackwell.
- Jolles, J., De Groot, R. H. M., Van Benthem, J., Dekkers, H., De Gloppe, C., Uijlings, H., et al. (2005). *Brain Lessons*. Maastricht: Neuropsych Publishers.
- Mareschal, D., Butterworth, B. & Tolmie, A. (2013). *Educational Neuroscience*. Oxford, UK: Wiley Blackwell.
- OECD. (2002). Neuromythologies. *Understanding the brain: Towards a new learning science*, 69-77.
- Pickering, S.J., & Howard-Jones, P. (2007). Educators' views on the role of neuroscience in education: Findings from a study of UK and international perspectives. *Mind, Brain, and Education*, 1(3): 109–113. doi:10.1111/j.1751- 228X.2007.00011.x.
- Ratoa, J. R., & Caldas, A. M. (2013). Neuromyths in education: what is fact and what is fiction for Portuguese teachers? *Educational Research*, 441-453.
- Samuels, B. M. (2009). Can differences between education and neuroscience be overcome by Mind, Brain, and Education? *Mind, Brain, and Education*, 45-53
- Tardif, E., Doudin, P.-A., & Meylan, N. (2015). Neuromyths among teachers and students teachers. *Mind, brain, and Education*, 50-59.
- Tuckman, B., & Monetti, D. (2010). *Educational psychology*. USA: Wadsworth Cengage Learning.
- UNICEF (2000). *Defining quality in education*. (Paper presented at the International Working Group on Education meeting, Florence, Italy, June).

Appendices

Appendix 1: Encuesta “Las neurociencias en el aula”

Información personal:

- Correo electrónico
- Fecha de Nacimiento
- ¿En qué nivel educativo se desempeña?
- ¿En qué tipo de establecimiento trabaja actualmente?
- ¿Cuántas horas cronológicas de docencia directa realiza?
- ¿En qué área desarrolla su labor?
- Título Profesional
- Universidad que le otorgó el título
- Año de ingreso
- Año de egreso
- ¿Ha realizado capacitaciones en Neurociencias?
- En una escala de 1 a 7, ¿Cómo evaluaría su interés en aprender sobre las aplicaciones de las neurociencias en educación
- ¿Conoce algún programa de capacitación asociado a neurociencias? (PNL, Brain, Gym, QLN, etc.)
- ¿Utiliza estrategias con base en las neurociencias en la práctica en el aula?
- ¿Lee revistas científicas populares?
- En una escala de 1 a 7, ¿Cómo evaluaría su conocimiento sobre neurociencias?
- En una escala de 1 a 7, ¿Cómo evaluaría su desempeño como profesor en comparación a otros docentes?

A continuación se presentan 32 afirmaciones, a las que debe responder “C” (correcto) o “I” (incorrecto) de acuerdo a sus conocimientos de neurociencias:

1. Utilizamos nuestro cerebro 24 horas al día.
2. Los niños deben adquirir la lengua materna antes de aprender una segunda lengua. De no ser así, no logran adquirir ninguno de los dos idiomas de manera óptima.
3. El cerebro de los niños es más grande que el de las niñas.
4. Si los estudiantes no toman suficiente agua (6 a 8 vasos al día), se les encoge el cerebro.
5. Se ha comprobado científicamente que los suplementos de ácidos grasos (omega-3 y omega-6) tienen un efecto positivo en el logro académico.
6. Cuando se daña un área del cerebro, alguna otra área pueden asumir su función.
7. Sólo utilizamos 10% de la capacidad cerebral.
8. El hemisferio izquierdo del cerebro siempre funciona junto con el hemisferio derecho.
9. La diferencia en la dominancia hemisférica (cerebro izquierdo, cerebro derecho) puede explicar en parte las diferencias individuales entre aprendices.
10. El cerebro de niños y niñas se desarrolla al mismo ritmo.
11. El desarrollo del cerebro termina antes de que los estudiantes lleguen a la enseñanza media.
12. Existen períodos críticos en la infancia para el aprendizaje, luego de los cuales un niño ya no puede aprender ciertas cosas.
13. La información se almacena en una red de células distribuidas en todo el cerebro.
14. El aprendizaje no se produce por la generación de nuevas células cerebrales.
15. Los estudiantes aprenden mejor cuando reciben información a través de su estilo de aprendizaje dominante (ej.: auditivo, visual, kinestésico).
16. El aprendizaje ocurre por la modificación de las conexiones neuronales del cerebro.
17. El logro académico puede verse afectado por no tomar desayuno.
18. El desarrollo normal del cerebro humano involucra la pérdida y generación de células cerebrales.
19. La capacidad mental es hereditaria y no puede modificarse por influencia del ambiente ni de la experiencia.

20. El ejercicio físico vigoroso puede mejorar el desempeño mental.
21. Un ambiente con mucha estimulación mejora el desarrollo del cerebro de los preescolares.
22. Los niños están menos atentos después de consumir bebidas o alimentos azucarados.
23. El ritmo circadiano (“reloj biológico”) cambia durante la adolescencia, razón por la cual los estudiantes están más cansados durante las primeras horas de clase de la mañana.
24. El consumo regular de cafeína reduce la capacidad de atención.
25. El ejercicio físico que involucra la coordinación de habilidades motoras y perceptivas puede mejorar la alfabetización.B36
26. El reforzamiento constante de ciertos procesos mentales puede cambiar la forma y estructura de ciertas partes del cerebro.
27. Cada estudiante muestra preferencia por una manera específica de recibir información (ej.: visual, auditiva, kinestésica).
28. La educación no puede remediar problemas de aprendizaje relacionados con el desarrollo de funciones cerebrales.
29. La producción de nuevas conexiones cerebrales puede continuar hasta una edad avanzada.
30. Sesiones cortas de ejercicios de coordinación pueden mejorar la integración de la función cerebral de los hemisferios (izquierdo y derecho).
31. Existen períodos sensibles en la infancia durante los cuales es más fácil aprender.
32. El cerebro deja de funcionar mientras dormimos.

Seguridad: En una escala de 1 a 7, evalúe su nivel de seguridad en responder la encuesta.

Appendix 2: Malla Curricular Pedagogía en Educación Media en Inglés, UCSC

SEMESTRE 1	SEMESTRE 2	SEMESTRE 3	SEMESTRE 4	SEMESTRE 5
Introducción a la Pedagogía	Teorías Curriculares	Introducción a la Didáctica	Diseño Curricular	Fundamentos de la Evaluación Educativa
Sociología Educativa	Psicología del Desarrollo	Psicología del Aprendizaje	Competencia Comunicativa en Inglés: Nivel Intermedio II	Gestión Educativa
Competencia Comunicativa en Inglés: Nivel Inicial I	Competencia Comunicativa en Inglés: Nivel Inicial II	Competencia Comunicativa en Inglés: Nivel Intermedio I	Fonética y Fonología del Inglés I	Competencia Comunicativa en Inglés: Nivel Intermedio Avanzado I
Alfabetización Académica I	Alfabetización Académica II	Doctrina Social de la Iglesia	Estudio del Sistema de la Lengua Inglesa	Fonética y Fonología del Inglés II
Fundamentos Filosóficos	Fundamentos Teológicos	Lingüística General	Lingüística Aplicada	Adquisición y Aprendizaje del Inglés
	Integración de Saberes	Integración de Saberes	Integración de Saberes	Optativo de Profundización
SEMESTRE 6	SEMESTRE 7	SEMESTRE 8	SEMESTRE 9	SEMESTRE 10
Evaluación de los Aprendizajes	Metodología de la Investigación Educativa	Seminario de Investigación	Escritura Académica en Lengua Inglesa	Práctica Profesional
Orientación Educativa	Competencia Comunicativa en Inglés: Nivel Avanzado	Lectura y Escritura en Lengua Inglesa: Nivel Avanzado	Literatura y Cultura de los Pueblos Angloparlantes	
Competencia Comunicativa en Inglés: Nivel Intermedio Avanzado II	Análisis del Discurso	Comprensión y Producción Oral en Lengua Inglesa: Nivel Avanzado	Enseñanza de Inglés a través de Tics	
Metodología de la Enseñanza del Inglés como Lengua Extranjera	Ética Profesional	Práctica Pedagógica III	Enfoques y Modelos Evaluativos para la Enseñanza del Inglés como Lengua Extranjera	
Práctica Pedagógica I	Optativo de Profundización	Optativo de Profundización	Práctica Pedagógica IV	
	Práctica Pedagógica II			

Appendix 3: Malla Curricular Educación Diferencial, Universidad de Concepción

Semestre 1	Semestre 2	Semestre 3	Semestre 4	Semestre 5	Semestre 6	Semestre 7	Semestre 8	Semestre 9	Semestre 10
EDUCACIÓN SOCIEDAD Y DESARROLLO HUMANO	LA PROFESIÓN DOCENTE	INCLUSIÓN Y EXCLUSIÓN SOCIAL EN EDUCACIÓN	PSICOLOGÍA EDUCATIVA	TEORÍAS Y DISEÑOS CURRICULARES	EVALUACIÓN PARA EL APRENDIZAJE	ORIENTACIÓN EDUCACIONAL	MÉTODOS DE LA INVESTIGACIÓN EDUCACIONAL	PRÁCTICA PROFESIONAL EN LA ESPECIALIDAD	
TECNOLOGÍAS DE LA INFORMACIÓN EN EL AULA	ALFABETIZACIÓN ACADÉMICA EN PEDAGOGÍA	ELECTIVO	ELECTIVO	ANÁLISIS ORGANIZACIONAL Y LIDERAZGO EDUCATIVO	ELECTIVO	PRÁCTICA AVANZADA I: DISEÑOS CURRICULAR EN DISCAPACIDAD INTELLECTUAL	PRÁCTICA AVANZADA II: APOYOS PSICOPEDAGÓGICOS EN DISCAPACIDAD INTELLECTUAL	TRABAJO DE TITULACIÓN	
SISTEMA ESCOLAR Y DIVERSIDAD	DIVERSIDAD Y DESARROLLO	ELECTIVO	PRÁCTICA INICIAL: INSTITUCIÓN ESCOLAR Y EDUCACIÓN ESPECIAL	COMPLEMENTARIO	PRÁCTICA INTERMEDIA I: DISEÑO Y PROCEDIMIENTOS EVALUATIVOS EN PERSONAS CON NECESIDADES EDUCATIVAS ESPECIALES ASOCIADAS A DISCAPACIDAD	PRINCIPIOS DIDÁCTICOS EN EDUCACIÓN ESPECIAL	DISEÑO DE INTERVENCIÓN PSICOPEDAGÓGICA		
INDUCCIÓN ACADÉMICA Y PROFESIONAL	NEURO ANATOMÍA	DISCAPACIDAD INTELLECTUAL Y DEL DESARROLLO	CONTEXTOS DE DESARROLLO Y APRENDIZAJE	PRÁCTICA INTERMEDIA I: DISCAPACIDAD INTELLECTUAL Y NECESIDADES EDUCATIVAS ESPECIALES	EVALUACIÓN EN DISCAPACIDAD INTELLECTUAL	ATENCIÓN TEMPRANA	NECESIDADES EDUCATIVAS ESPECIALES MÚLTIPLES		
ARTE, TECNOLOGÍA Y NECESIDADES DE APOYO	MÚSICA Y NECESIDADES DE APOYO	NEUROCIENCIAS	COMUNICACIÓN, LENGUAJE Y PENSAMIENTO	DESARROLLO PSICOLÓGICO Y SOCIAL EN DISCAPACIDAD INTELLECTUAL	INTEGRACIÓN LABORAL Y CALIDAD DE VIDA	DIDÁCTICA DE LAS MATEMÁTICAS PARA DISCAPACIDAD INTELLECTUAL	DIDÁCTICA DE LAS CIENCIAS NATURALES Y SOCIALES		
		PSICOMETRICIDAD Y NECESIDADES DE APOYO		DIDÁCTICA DEL LENGUAJE PARA DISCAPACIDAD INTELLECTUAL	DIDÁCTICA DE LAS MATEMÁTICAS	ELECTIVO	ELECTIVO		

Appendix 4: Malla Curricular Educación General Básica, Pontificia Universidad Católica de Valparaíso

I SEM	II SEM	III SEM	IV SEM	V SEM	VI SEM	VII SEM	VIII SEM	IX SEM
COMPRESIÓN LECTORA 3 CREDITOS LCL123			CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL DE LA LECTURA Y ESCRITURA 2 3 CREDITOS EBA 298	CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL SOBRE EL LENGUAJE Y LA COMUNICACIÓN 1 4 CRÉDITOS EBA 320	CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL SOBRE EL LENGUAJE Y LA COMUNICACIÓN 2 4 CRÉDITOS EBA330	EDUCACIÓN FÍSICA EN LA INFANCIA 3 CREDITOS EF1438		
FDTOS. FILOS. Y SOCIO-ANTROP. DE LA EDUL. 3 CREDITOS EPE1121	CULTURA Y ORGANIZACIÓN ESCOLAR 3 CRÉDITOS EPE1136	NEUROCIENCIA Y EDUCACIÓN 3 CREDITOS EPE1222	PLANIFICACIÓN CURRICULAR 4 CREDITOS EPE1273	EVALUACIÓN PARA EL APRENDIZAJE 4 CREDITOS EPE1331		INVESTIGACIÓN PEDAGÓGICA 3 CREDITOS EPE1428	TRABAJO DE TITULACIÓN 8 CRÉDITOS EPE1500	
IDENTIDAD PROFESIONAL DOCENTE 3 CREDITOS EPE1128	NATURALEZA Y CONSTRUC. DE LA CIENCIA 3 CREDITOS CBM155	CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL SOBRE EL MUNDO NATURAL 1 4 CREDITOS EBA225	CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL SOBRE EL MUNDO NATURAL 2 4 CREDITOS EBA275	MENCIÓN 3 CREDITOS	MENCIÓN 3 CREDITOS	MENCIÓN 3 CREDITOS		
CONSTRUCCIÓN INTEGRADA DEL CONOC. HIST. GEOG Y DE LAS CS. SOCIALES 3 CREDITOS HIS133	CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL DE LAS ARTES 4 CREDITOS EBA139	CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL SOBRE EL MUNDO SOCIAL 1 4 CREDITOS EBA219	CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL SOBRE EL MUNDO SOCIAL 2 4 CREDITOS EBA289	MENCIÓN 3 CREDITOS	MENCIÓN 3 CREDITOS	MENCIÓN 3 CREDITOS	MENCIÓN 3 CREDITOS	
NÚMEROS: ESTRUCTURAS ADITIVAS 3 CREDITOS MAT179	INICIACIÓN AL PENSAMIENTO MATEMÁTICO 4 CREDITOS EBA150	PENSAMIENTO GEOMÉTRICO 3 CREDITOS EBA 215	CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL SOBRE EL MUNDO GEOMÉTRICO 3 CRÉDITOS EBA280			CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL SOBRE PROBABILIDAD Y AZAR 3 CREDITOS EBA480		
	PSICOLOGÍA DEL DESARROLLO 3 CREDITOS PSI125	PSICOLOGÍA DEL APRENDIZAJE ESCOLAR 3 CRÉDITOS PSI235		EDUCACIÓN INCLUSIVA 3 CRÉDITOS EPE319	CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL DE LA EDUCACIÓN TECNOLÓGICA 4 CREDITOS EBA375	VISION CRISTIANA DEL AMOR Y LA SEX. 2 CRÉDITOS ICR229		
PRÁCTICA DOCENTE INICIAL 4 CRÉDITOS PRAEBA100		CONSTRUCCIÓN DEL CONOCIMIENTO INFANTIL DE LA LECTURA Y ESCRITURA 1 3 CREDITOS EBA228	ORIENTACIÓN EDUCACIONAL Y FAMILIAR 3 CRÉDITOS EPE1284	INTEGRACIÓN CURRICULAR EN PRIMER CICLO 4 CREDITOS EBA328	PRÁCTICA DOCENTE INTERMEDIA 8 CRÉDITOS PRAEBA300	EDUCAR EN VALORES 3 CREDITOS EPE1438	PRÁCTICA PROFESIONAL DE PRIMER CICLO 8 CREDITOS PRAEBA400	PRÁCTICA PROFESIONAL DE MENCIÓN 4 CREDITOS PRAEBA500

MENCIÓN

PRÁCTICA

LICENCIATURA

Se agregan además 10 créditos en asignaturas de Formación Fundamental y 6 créditos en asignaturas Optativas